

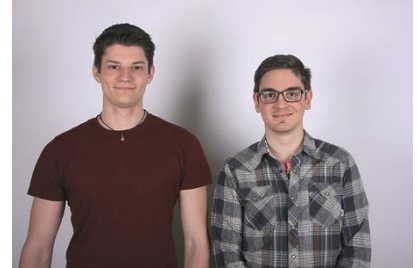
## Energy Harvesting Circuit for piezoelectric Harvester

Autarkic Systems consist of a harvester, an energy converter, an energy storage and an attached load at the output. The primary function of the harvester is to convert energy from its surrounding into electricity. This bachelor thesis focuses on the development of an electrical circuit, which can extract energy from a piezoelectric transverse beam. In the centerpiece of this paper lies the Synchronized Switch Harvesting on Inductor (SSHI) circuit. SSHI can be divided into two categories, specifically the parallel (SSHI-P) and the serial (SSHI-S) circuit. The goal is to utilize a self-powered version of this circuit, which on the one hand is frequency independent and on the other hand works flawlessly with several different types of piezoelectric harvesters. In order for the SSHI circuit to achieve optimal results, the frequency of the vibrating source should remain constant.

The results show, that implementing the SSHI-S circuit at low frequencies below 100 Hz is most beneficial for a positive energy extraction. But minor changes to the system might lead to considerable discrepancies. Furthermore to attain the highest possible efficiency with the SSHI-S circuit, a low-impedance and for the SSHI-P circuit a high-impedance load should be connected to the output terminals. A prototype was designed, which incorporates the advantages of both these circuits.

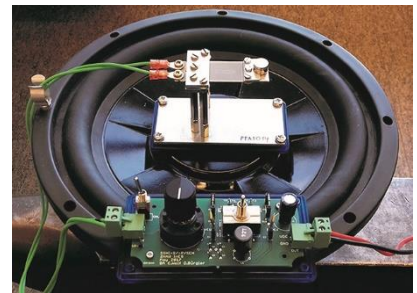
Furthermore an enhancement of the SSHI-S circuit is developed, which utilizes a double coil arrangement (SSHDI-S). It improves the output performance significantly. Compared to a bridge rectifier at low-impedance until 80 k $\Omega$  loads it at least triples the power.

The insights gained from this bachelor thesis and the comparison of the achieved results may play a decisive role for the general comprehension and for future studies in the field of piezoelectric based energy harvesting systems.

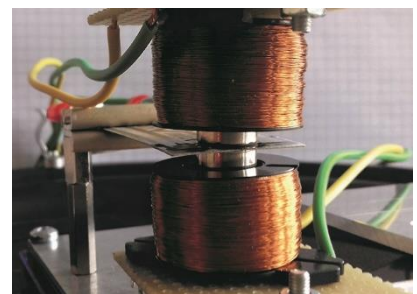


Diplomierende  
Daniel Bürgler  
Christian Wolf

Dozent  
Juan-Mario Gruber



A piezoelectric transverse beam is mounted to a energy harvesting system. The energy ist extracted with a SSHI circuit



Energy harvesting with the double-coil arrangement (SSHDI-S)